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ABSTRACT

Findings of a study that explored the ways in which teachers' understandings about pedagogy evolve are presented in this paper. Previous teacher development research suggests that teachers' understandings evolve in a lawful, linear way. Although the expression of the different levels is clear, the evolution process is not. Methodology involved a "microgenetic" analysis of the weekly journal entries made by a student teacher enrolled in the Developmental Teacher Education Program at the University of California at Berkeley. Findings suggest that pedagogical thinking develops through conflicts that arise when previous ways of thinking about issues related to learning and teaching are inadequate in new classroom situations. A conclusion is that teacher educators can use journals to implement innovative curricula and engage students in developmentally appropriate activities and discussions. (LMI)

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A Microgenetic Analysis of Restructuring in a Teacher's Understandings about Learning and Teaching

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Abstract

Previous research in the area of teacher development suggests that teachers' understandings about pedagogy evolve in a lawful, stage-like fashion. While the expression of these different levels is clear, the process of evolution is not. Weekly journals of student teachers can provide insight into this process. A detailed, "microgenetic", analysis of one student teacher enrolled in the Developmental Teacher Education Program at the University of California at Berkeley provides evidence that pedagogical thinking develops through conflicts arising when previous ways of thinking about issues related to learning and teaching are inadequate in new classroom situations.

Current educational reform aims to help students understand subject matter conceptually. This provides opportunities for innovative curricula integrating cognitive developmental theory with classroom reality. These innovative curricula assume the teacher knows how to take an active role in creating developmentally appropriate activities that stimulate students to reason about subject matter. As we attempt to reshape the nature of pedagogy to address the academic and social needs of individual students, we must also attend to the development of the teachers who give life to pedagogy in the classroom.

Research initiated by Ammon, Hutcheson, and Black (1985) suggests that teachers' understanding of pedagogy evolves in a lawful, stage-like fashion. Ammon and his co-workers have described the development of teachers' pedagogical thinking in terms of five levels, beginning with empiricist and behaviorist conceptions, and going on to developmental constructivist conceptions that become increasingly differentiated and integrated (Ammon and Levin, 1991). Each succeeding level incorporates elements of the preceding level, while constituting a basis for solving pedagogical problems that preceding conceptions may have created.

In the complete model proposed by Ammon et al., each level involves thinking about issues in four areas: the determinants of child behavior; the nature of development; learning; and teaching. We will focus on some issues having to do with the areas of learning and teaching. As shown in Table 1, the issues are (1) the goals of instruction (what is to be learned in school), (2) what students do to attain the goals of instruction, and (3) what teachers do to help students attain these goals.

-Insert Table 1 about here-

It can be seen in Table 1 that not until level 4 do teachers begin to think about pedagogy in ways consistent with curricula that are intended to foster conceptual understandings. Prior to level 4, the teacher believes that his/her role is to impart information and skills as prescribed by "received" curricula (levels 1 and 2), or to provide materials from which students can derive correct understandings that they are developmentally ready to attain, through their own exploration and discovery (level 3).

Data and Procedure

There is evidence that many of today's teachers have not progressed as far as level 4, and that the attainment of level 4 does not come easily (Costello, 1988; Schreiter, in progress). Our current goal is to understand how teachers progress through these stages so that ultimately we can help more teachers learn to work effectively with the new curricula. To this end we analyzed weekly journal entries written by Theresa, a student in a two year graduate program at Berkeley, the Developmental Teacher Education Program. The DTE program emphasizes integrating developmental theory with teaching. Throughout their two years, student teachers keep weekly journals in which they are encouraged to write about their experiences in their field placement classrooms. The students are given a standard form to fill out each week. On this form they are asked to describe their student teaching activities, their goals for that week, to evaluate the gains they have made, and to consider the processes that have led them to their evaluations. Students may also depart from the standard format, provided they describe and reflect upon their classroom experiences as student teachers. Findings from previous studies at Berkeley suggest that the DTE program is effective in helping teachers develop constructivist approaches to learning and teaching. In one study, Hutcheson and Ammon (1986) examined the weekly journals of two student teachers and found evidence of shifts from level 2 to 3, and then from 3 to 4, over the course of two years. One of those student teachers was Theresa, whose data are presented in Figure 1.

-Insert Figure 1 about here-

Figure 1 (from Hutcheson & Ammon, 1987) shows the percentage of responses at different levels of conception for Theresa over the course of her five placements. The horizontal axis shows the 2 year span of time Theresa was in the program. There were three 10-week placements during the first year, and two 15-week placements during the second year. Data from entering and graduating interviews with Theresa are also represented on the same time-line. The vertical axis of the graph indicates the percentage of responses coded at a given level of conception for journal entries associated with each placement, and for the two interviews. The data shown here have been collapsed across the four coding areas (i.e. behavior, development, learning, and teaching) because, with few exceptions, the data from all four areas were congruent .

Figure 1 indicates that Theresa's entering interview and early journal entries showed a preponderance of level 2 conceptions, while the dominant level in her journal entries at end of the program and in her graduating interview was level 4. Theresa's thinking shifted dramatically from level 2 to 3 during her third and fourth placement, and from 3 to 4 during her fourth and fifth placements.

The representation of Theresa's journal data in Figure 1 shows the nature and approximate timing of shifts that occurred in her thinking over two years, but it does not show us how these shifts came about. To get at the developmental process, we need something akin to a "microgenetic" analysis, i.e., an analysis where the density of observations is high relative to the rate of change, and where observations can be analyzed intensively to make inferences about the process of change (Siegler, 1991). We have attempted such a microgenetic analysis by looking at Theresa's journals in a more detailed, week-by-week fashion. Therefore, for the present study, we have returned to the raw data in Theresa's weekly journal entries in detail and tracked her thoughts about issues related to learning and teaching, specifically the goals of instruction, what students do to attain the goals, and what teachers do to help children attain these goals.

Results

When Theresa encountered new classroom situations, she found that she had to reconsider previous ways of thinking about issues in the areas of learning and teaching in order to provide students opportunities to attain her current instructional objectives. Theresa's journal data reveals that her attempts to integrate pedagogical theory with classroom practice led her to take a more active role in creating activities and tasks that engaged students in the process of reasoning about particular concepts. The more salient it became to Theresa that she was not simply a liaison between curricula and the students, the more flexible she became to provide students a learning environment in which they were encouraged to reason about subject matter in terms of their present developmental levels.

These findings are supported by numerous entries in Theresa's journals. While in her third placement, a first grade classroom, Theresa's instructional goal is that students acquire skills that are essential for attaining and using specific kinds of facts and procedures (a level 2 conception of the goal of

instruction). She writes about her attempt to interest the students in the process of writing by providing opportunities for them to discuss relevant concepts and strategies that would enable them to find a topic, generate complete sentences, and so on. For example, in week two of the placement Theresa writes:

> My purpose and goal for this visit is to initiate a writing group by interesting the students in the writing process. Specifically with brainstorming activities, and a discussion of how one comes up with a topic.

Another excerpt from this journal entry reveals that her conception of how learners acquire the skills and strategies related to writing is consistent with the aforementioned instructional goals. She believes that in order to acquire these strategies and skills, students must practice them, and also imitate more advanced peers. (This view of the learner's role also reflects a level 2 conception.) Theresa writes:

> The students seemed to grasp fairly quickly what we were after. Their initial strategy was to specify who, what, and where. They did not add why's or adjectives. My assumption is that this is probably not unusual with six or seven year olds, who are more able to manipulate concrete objects. I suspect that if they did several other expansions, they would begin to try out different possibilities. I believe this would be an especially good activity for the whole class, since the more verbally facile could model a variety of passages.

Theresa sees herself as the "agent" responsible for imparting skills, facts, rules, and procedures, and for keeping students "on task." She finds it quite challenging to provide individual remediation while attending to the needs of the other children during her second and fourth weeks of this placement. In the following passage Theresa describes an attempt to integrate a particular student into a writing lesson. She has some ideas about how to address his needs, but decides she should attend to the others. She begins to see that integrating writing with other activities would enable the other students to continue on their own. However, her present level 2 notion that she is

responsible for imparting information and keeping students on task precludes this option. Theresa writes:

> What impresses me most about this first group is their willingness to write, their readiness to to make changes, and their excitement in sharing what they had written. Now though, I wish even more that I figured out a way to integrate "M". I think it might have been valuable for him to see that writing is something to be shared, not just a teacher's assignment. I have thought about putting him in the next group, but I decided that since I am also doing reading with him, I should give the other children a chance to do one of the extra activities. They don't all really know what I am doing, but it is still considered a privilege to do it. The students wanted to have yet another writing session and said that they wanted to continue to add on to their stories. In this case, though, I felt I had to cut it off to give other children a chance. In a classroom where the writing was completely integrated, they could continue on these pieces as long as they wanted. In that situation, however, I do not feel they would continue to work on them.

Theresa's fourth placement, a second-third grade classroom, presents a situation in which her previous methods are not effective. Until this placement, Theresa relied on practice exercises and using more accomplished students as models to achieve her instructional objectives. These are level 2 notions. Now she must teach math to a group of second graders. This creates a "management challenge." It is the only hour when the third graders cannot model for the second graders. Theresa has trouble arranging instruction and work time without the "examples" she had before. She must find new ways to keep students on-task and still give individual attention. Theresa writes:

> My purpose and goal for this visit is to reorganize math time so as to help children as diverse as "J" and "V" to be productive. The math hour has become my major management challenge. I have all of the second graders, which for me means that for the only time during the day, I do not have the example of the more self-directed third graders. My problem is how can I arrange

> instruction, workbook time, and give time so that all of the children have something to do that they can do so that classroom behavior is in enough control to allow all of the children the freedom to work. When I first started with Real Math curriculum I followed their guidelines. They usually begin with a few story problems, then have instruction/discussion period, then workshop which is usually a game then workbook time. I quickly found that I did not like this solution. The children who finished the workbook quickly were left with little to do. I have found that although children enjoy games, they get tired of them. My future goals include developing some challenges for more able children and finding more time for individual instruction.

What she does at this point is to tailor the mandated curriculum to account for differences in ability in order to cultivate learning for understanding, as opposed to expecting the students to memorize facts and algorithms. This shows a shift both in her conception of her role and in the goal of instruction. Before she presented facts, gave students practice, etc. to help the students acquire skills in using the facts; now she works with the curriculum to help students understand the material conceptually. She describes a particular child who does not memorize the algorithms as the curriculum experts mandate but, by using her fingers, can accurately come up with the correct answers at her own pace. Theresa concludes that she is discovering that memorization does not necessarily indicate understanding. These are level 3 views. She writes:

> At first I followed the Real Math program exactly, but now I find myself making some adjustments. I have shortened drill time and have added some group strategy games. I also let the children who want to, use manipulatives, although the Real Math people feel that children should be memorizing number facts. A particular student is case in point of why I don't believe too much in that, at least not in the second grade. This student has few problems memorized, but by using her fingers, she can get the correct answers. As I am quickly learning with these children, memorization does not necessarily indicate understanding.

Four weeks later, while in this fourth placement, Theresa attempts to provide an opportunity for the students to attain the correct understanding of concepts via a hands-on task using manipulatives. She writes:

> Since nine of the ten students needed extra help on two digit addition, I decided to spend some whole group time on this concept. I began again from the beginning using popsicle sticks for regrouping, then moving into algorithm. Special emphasis was placed on the types of two digit problems causing the most difficulties. All of the children were then given a dittoed worksheet which was to serve as a second evaluation. My theory was that children who understood the concept but made careless mistakes would now correct them [as a result of using manipulatives].

This is a level 3 conception of the learner's role. During her third placement, Theresa thought students learn by practicing and modeling; now she thinks students learn by working with "developmentally appropriate materials." Her role is to provide students opportunities to work with the material so they can acquire concepts that lead to "the correct" answer.

We will now illustrate Theresa's continued development from level 3 to 4. When Theresa enters her fifth placement, a sixth grade classroom, she describes the classroom organization from a level 3 perspective in her journal:

> The classroom is set up with desks clustered in groups of three to five, but the children do not function in groups. In fact, individual effort is strongly emphasized. Some mobility about the room is considered acceptable during work time, especially to and from the two classroom computers. There seem to be few consistent rules about talking. During whole group sessions, which are few, absolute silence may be required. At other times there appears to be no set standard, and the talking ranges from minimal to extensive. Most all of the activities are teacher chosen and directed. There is little group instruction. Much of the school day is spent working individually on assignments. Firm criteria are set for each assignment, which all students are expected to meet equally. There appears to be little account taken for

> developmental differences between students. Most activities tend to fall into the abstract mode, and there is minimal use of concrete objects.

Theresa's concern that students in this classroom do not have opportunities to interact or to engage in hands-on activities reflects a level three notion that teachers should encourage interaction with objects and with other students, to foster correct understandings of developmentally appropriate subject matter.

Two weeks later in this placement, Theresa is asked to teach a unit on Canada. A comprehensive, "abstract" social studies topic like this cannot be understood through interaction with manipulatives alone, as she believed mathematical concepts could be in her previous placement. Also, with mathematics it seemed clear what the correct understanding should be, but in the Canada unit there is more latitude for different ways of thinking about the subject matter. She states:

> My purpose and goal for this visit is to plan a social studies unit to emphasize thinking process over fact recall. The topic "Canada" was given to me as a topic. The reason given to teaching a unit on Canada is that it boarders the U.S. I question whether that is a compelling reason for studying the country for students at the sixth grade level. When I began to read the textbook I was required to use, I was even more disheartened at the prospect of teaching this unit. The text emphasized facts without demanding much interpretation by the reader. My first task for myself as well as for the students' sake, was to develop a rationale for studying Canada. After reading through the textbook selections I decided that it would be best to relate the new information to old information. Throughout this unit we would compare and contrast Canada and the U.S. That comparison should strengthen understanding of our own country, as well as provide a framework. Since many of the facts presented in the text were eminently forgettable, I decided to emphasize concepts of historical analysis as opposed to fact recall. For each section in the text, I developed some questions that required the students to use the facts presented to develop theories and conclusions. With that

> groundwork I brainstormed for some additional enrichment activities that would extend the concepts we were developing. By the time I finished with that, I was actually interested in teaching the unit, and began to wonder how I could fit it all into four weeks.

Theresa de-emphasizes facts and does not seem to think there is a "correct understanding" of the material. Three weeks later, she devises an enrichment activity to help the students focus on the relationships between Canadian and U.S. history. She believes children must think for themselves to attain conceptual understandings (level 4), in addition to interacting with people and objects, and that her role is to guide students' thinking to better understand the subject matter. This contrasts with her previous level 3 notion that by simply providing students with developmentally appropriate materials they will arrive at "the" correct understanding. Theresa writes:

> In this task I had to work under certain restrictions. Whereas I might have suggested a wide variety of report topics, I was told that the reports must be on one of the provinces. There was also a specific report format that the students were required to follow. What I was able to do was to rearrange the outline. It seemed to me that some of the headings from last years outline were not in logical order. Under geography, for example, major cities came between climate and natural resources. It seemed logical to consider the climates influence on natural resources and then apply that knowledge to writing about why the major cities have prospered. All of the notes are my attempt to get the students to consider how the concepts affect one another. I want them to do some thinking instead of just compile information. In our discussions we talk a lot about the interrelationships between events as well as their causal relationships. But in the discussions, the students have my guidance, as well as the support of their peers. We all work together to formulate new connections. With this report, however, I want to see how many of the students can make the connections themselves. I suspect that this will be too difficult for most of the students, unless one of their sources make the relationships explicit, but I think they need to try.

> I also made one addition to the report. The required travel itinerary for an "A". This is another attempt to get the students to formulate facts into new forms. Done well , the travel itinerary will require the students to pull together all they know about the province. They will have to glean out what is essential, and then organize. Many aspects of this activity can be quite complex. How long will you stay in one place? How many sites can be seen in one day? In what order will you make your various stops? I will be interested to see what the students do with this. I hope they enjoy it.

Conclusions

We have discussed only a very small sample of Theresa's journal writing. Other entries in Theresa's journals reveal a similar process of conceptual restructuring. These data provide insight into the nature of the process that teachers go through to understand their role as active participants in the equally active learning process of the individual students in their classrooms. These excerpts and many others strongly suggest that Theresa's pedagogical thinking developed through conflicts arising when her way of thinking about issues related to learning and teaching were inadequate in new classroom situations. Teachers' journals provide insight into how they view their roles in the classroom, and how their conceptions change with experience and education. Teacher educators can use the insights gleaned from a microgenetic analysis of student teachers' journals to help them implement innovative curricula and engage their students in thoughtful, developmentally appropriate activities and discussions conducive to learning for understanding.

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Table 1

Teachers' Conceptions at Five Levels of Thinking about Teaching and Learning

Qualitative level of Pedagogical Conception	The Goal of Instruction is for Students to Attain:	In Order to Attain Instructional Objectives, Students Must:	Teachers Promote the Attainment of Instructional Objectives By:
Naive Empiricism	1.A large store of facts and procedures.	1.Be able and receptive.	1.Telling and showing.
Everyday Behaviorism	2.Skills that are essential for attaining and using facts and procedures	2.Practice new skills, having first acquired prerequisite skills.	2.Giving students practice, with corrective feedback and positive reinforcement.
Global Constructivism	3.Correct understandings of concepts that underlie facts, procedures and skills in a given subject.	3.Manipulate and explore relevant aspects of reality, having reached the required developmental stage.	3.Giving students opportunities to explore and manipulate developmentally appropriate materials.
Differentiated Constructivism	4.Conceptual understandings that are better than before and may improve still further.	4.Use their best thinking to construct understandings consistent with their present level of development.	4.Engaging students in thought-provoking activities and guiding their thinking toward better understandings.
Integrated Constructivism	5.Ways of thinking that can lead to better understandings.	5.Reflect on their thinking with respect to its general characteristics.	5.Helping students examine their own thinking.

Figure 1. Percentage of Responses at Levels 2, 3, and 4 in Journals and Interviews for Theresa